Questions are for both separate science and combined science students

Q1.

Some isotopes emit nuclear radiation.

(a) Carbon-12 and carbon-14 are both isotopes of carbon.

Complete the sentences.

Choose answers from the box.

alpha particles	**electrons**	**neutrons**	**protons**

The nucleus of a carbon-12 atom and the nucleus of a carbon-14 atom have the

same number of _____.

The nucleus of a carbon-12 atom and the nucleus of a carbon-14 atom have a

different number of _____.

(2)

(b) Different radioactive isotopes have different half-lives.

What does 'half-life' mean?

Tick (✓) **one** box.

Half the time taken for all of the nuclei in a sample to decay. ☐

The time taken for half the nuclei in a sample to decay. ☐

The time taken for one nucleus to split in half. ☐

(1)

(c) **Table 1** shows the half-life of some different isotopes of carbon.

Table 1

Isotope	Half-life in seconds
Carbon-15	2.45
Carbon-16	0.75
Carbon-17	0.19
Carbon-18	0.09

Which isotope is the least stable?

Tick (✓) **one** box.

Carbon-15 ☐

Carbon-16 ☐

Carbon-17 ☐

Carbon-18 ☐

(1)

(d) Workers in nuclear power stations must be aware of nuclear irradiation and radioactive contamination.

Draw **one** line from each term to an example of the term.

Term	Example
Radioactive contamination	Exposure to a beam of gamma rays
Nuclear irradiation	Exposure to ultraviolet radiation from the Sun
	Accidental transfer of plutonium onto a human body
	Using a mobile phone

(2)

(e) Why are workers required to walk across a sticky floor before leaving the nuclear power station?

Tick (✓) **one** box.

- To remove alpha particles from their shoes. ☐
- To remove gamma radiation from their shoes. ☐
- To remove radioactive dust from their shoes. ☐

(1)

(f) The places where people work and live contribute to the nuclear radiation they are exposed to.

Table 2 shows the mean daily dose of radiation caused by two different jobs.

Table 2

Job	Mean daily dose in mSv
Aeroplane pilot	0.072
Nuclear power station worker	0.00050

Calculate the number of days a nuclear power station worker must work before receiving the same dose that an aeroplane pilot receives in one day.

_____

_____

_____

Number of days = _____

(2)

(g) The process of nuclear fission takes place in nuclear power stations.

The process of nuclear fusion takes place in the Sun.

Draw **one** line from each process to its fuel.

Process	Fuel
Nuclear fission	Hydrogen
	Iron
Nuclear fusion	Lead
	Uranium

(2)

(Total 11 marks)